OCCUPATIONAL AND NONOCCUPATIONAL FATALITIES ON U.S. FARMS

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United States Department of Agriculture

Agricultural Economic Report No. 356

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ABSTRACT

Benchmark data for farm fatalities are developed and analyzed by region and age groups. During 1969-71, occupational fatality rates for farmers and hired farmworkers were between 23.5 and 28 per 100,000 workers. The fatality rate for all farm residents and workers in 1973 was 16.2 per 100,000 persons, down from 17.7 in 1967. Fatalities occur with much greater frequency to persons age 55 and over than to persons under age 55. A greater proportion of self-employed farmworkers are in this higher risk age category than are hired workers, implying that overall occupational fatality rates for self-employed operators are higher than for hired workers.

Keywords: Fatal accidents, Fatalities, Occupational fatalities, Nonoccupational fatalities, Farm accidents, Farm labor force, Farm population.

Washington, D.C. 20250 October 1976

CONTENTS

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States included in each region are:

Northeast	Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland
Appalachian	Virginia, West Virginia, North Carolina, Kentucky, Tennessee
Southeast	South Carolina, Georgia, Florida, Alabama
Delta	Mississippi, Arkansas, Louisiana
Corn Belt	Ohio, Indiana, Illinois, Iowa, Missouri
Lake States	Michigan, Wisconsin, Minnesota
Northern Plains	North Dakota, South Dakota, Nebraska, Kansas
Southern Plains	Oklahoma, Texas
Mountain	Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada
Pacific	Washington, Oregon, California

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Acknowledgments

Walter E. Sellers, Jr., collaborated in the planning of this report and in the writing of an earlier draft. The report was completed under the general supervision of Robert D. Reinsel, Leader, Inputs and Finance Program, National Economic Analysis Division.

SUMMARY

In 1973, a total of 1,769 accidental deaths occurred on U.S. farms, according to the National Center for Health Statistics. Excluded from this total are vehicular deaths on public roads and deaths occurring in the farm home. Based on occupational fatality rates developed for 1969-71, from 60 to 70 percent of the 1973 farm fatalities were directly related to the farmwork environment.

Accidents involving machinery were the major cause of the 1969-71 fatalities, but regional variations were large. Machinery and related factors were involved in almost half of the accidental deaths in the Northern Plains during the period, compared with less than 30 percent in the Southern Plains.

Drownings and firearm deaths accounted for about one-fourth of the accidental deaths on farms. Drownings occurred with greatest frequency in the Southeastern States, and firearm fatalities occurred most often in the Southern Plains.

Accidental fatalities occur with greatest relative frequency to older persons. Accidental fatalities to persons 65 years old and older occurred at almost twice this age group's proportional representation in the farm population and labor force. The incidence of accidental fatalities to persons under 55 was less than their population and work force representation. Drownings occurred with greatest frequency to persons under 25, and machinery-related fatalities were responsible for over half of the accidental deaths of persons 45 and older. Persons 45 to 59 years old--an age group within the actively working age range--experienced more fatalities related to blows than did persons 60 and older. Falls were the second most important cause of accidental death of persons 60 and older, ranking behind machinery-related fatalities.

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by
Conrad F. Fritsch*

INTRODUCTION

Farm fatalities are analyzed for the years 1960-73 from data compiled by the National Center for Health Statistics, U.S. Department of Health, Education, and Welfare. This is the only comprehensive source of national fatality data identifying accidental deaths occurring on farm lands and in and around farm buildings. Fatalities occurring in the farm home are excluded from this data source.

Benchmark estimates for current rates of occupationally related fatalities in agriculture, especially those involving hired employees, are required to assess the effectiveness of the Williams-Steiger Occupational Safety and Health Act of 1970 (OSHA). Under this legislation, the Secretary of Labor is empowered to set forth regulations or standards to reduce accidental illnesses, injuries, and deaths due to occupational hazards. The act applies only to hired employees in private establishments, including agriculture. Its jurisdiction extends only to occupational hazards.

Yet many farm accidents and fatalities are nonwork related. Agriculture is unique among industries in that the work environment, including farm land and buildings and certain equipment such as wagons and tractors, is used for recreational as well as occupational purposes. In addition, many farm fatalities are related to recreational activities such as swimming and hunting, and many farm children, youth, and adults are killed or maimed each year from accidents occurring around the farmstead which are not the direct result of work exposure. A well-coordinated farm safety education program must therefore focus on the reduction of causal conditions responsible for both occupational and nonoccupational injuries and illnesses.

Statistics sufficiently accurate to distinguish between occupational and nonoccupational accidents on farms are required to determine progress toward the goal of reducing such accidents. The data in this report provide an initial analysis of regional and age-specific farm fatalities by causal factors and a procedure is developed to estimate the distribution of occupational and nonoccupational fatalities.

HISTORICAL TRENDS

For many years, farming was considered a way of life and only incidentally as a business. But rapid mechanization over the past two decades, combined with farm

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consolidation involving outmigration of many farm residents and farmworkers has resulted in an increased emphasis on the business aspects of agriculture. The traditional family farm was labor intensive and dependent on only a few off-farm inputs. Modern agriculture is capital intensive, with manufactured inputs accounting for over 60 percent of total farm expenses. 1/ These changes have contributed to almost a fourfold increase in hourly output per worker since 1950. 2/ Moreover, families dependent on agriculture for a livelihood, whether owner-operators or hired employees, are comparing their economic well-being to standards set by their nonagricultural neighbors.

As the business aspects of farming developed, labor-management relations became more formalized. Many agricultural employees are now covered by Federal social security, minimum wage, occupational safety and health, and unemployment compensation legislation. Also, farm employers must meet minimum housing standards for housing supplied to employees and must adhere to certain provisions of the Farm Labor Contractor's Registration Act in the event that they use hired labor supplied by independent contractors.

Passage of the Occupational Safety and Health Act sharpened the focus of agricultural safety leaders on occupational hazards. While the legislation's mandate is limited to farms hiring labor, its impact can indirectly extend to self-employed operators on all farms, since regulations designed to reduce work hazards to hired employees may also reduce the probability of accident and fatality occurrences to owner-operators. Certain regulations, such as those requiring rollover protection for hired tractor operators, further serve to create a safer work environment for all persons using tractors. In other situations, however, reduction of occupational injuries, illnesses, and deaths can best be achieved through a concerted and well-coordinated program of safety and health education.

Fatalities on farms in 1973 totaled 1,769 (table 1). This figure includes fatalities resulting from both occupational and nonoccupational farm activities, but excludes home accidents and those involving the use of cars and trucks on public highways. In 1973, about 26 percent fewer farm fatalities occurred than in 1960, but the fatality rate per 100,000 farm residents and workers increased from 14.2 to 16.2 Gradual increases in fatality rates were registered up to 1967, and then a declining trend developed through 1972.

NATIONAL AND REGIONAL ANALYSIS OF FARM FATALITIES

This section includes discussion of recorded fatalities occurring on farmlands, including fatalities sustained in and around farm buildings, as reported by the National Center for Health Statistics. Analysis of occupational farm fatalities is made in the following section. These occupational farm fatalities comprise a subset of the data describing all farm fatalities.

National Trends

Nationally, about 43 percent of the 1973 farm fatalities were due to machinery or machinery-related causes (table 2). Included in this category are deaths resulting from persons being "struck by or against an object" or from "being caught between

1/ Robert D. Reinsel, "Outlook for Prices and Supplies of Inputs," talk presented at U.S. Dept. of Agr., National Agricultural Outlook Conference, Nov. 18, 1975.
2/ 1975 Changes in Farm Production and Efficiency, A Summary Report, Stat. Bull. 548, U.S. Dept. of Agr., Econ. Res. Serv., Sept. 1975.

Table 1--Accidental farm fatalities, 1960-73 1/

Year	Persons exposed to farm hazards			Total fatalities	Fatality rate Per 100,000
	Nonfarm residents working on farms	Farm population	Total		
	Thousands			Number	
1960	1,370	15,635	17,005	2,407	14.2
1961	1,529	14,803	16,332	2,403	14.7
1962	1,529	14,313	15,842	2,246	14.2
1963	1,609	13,367	14,976	2,309	15.4
1964	1,609	12,954	14,563	2,279	15.7
1965	1,564	12,363	13,927	2,321	16.7
1966	1,461	11,595	13,056	2,165	16.6
1967	1,466	10,875	12,341	2,183	17.7
1968	1,522	10,454	11,976	NA	NA
1969	1,378	10,307	11,685	1,951	16.7
1970	1,363	9,712	11,075	1,795	16.2
1971	1,377	9,425	10,802	1,717	15.9
1972	1,370	9,610	10,980	1,712	15.6
1973	1,480	9,472	10,952	1,769	16.2
1974	1,531	9,264	10,795	NA	NA

NA = Not available.

1/ Data exclude home accidents and those involving cars and trucks on public highways.

Sources: U.S. Dept. of Commerce, Farm Population Series, P-27, various issues; and U.S. Dept. of Health, Education, and Welfare, National Center for Health Statistics.

Table 2--Accidental farm fatalities by cause, averages 1954-64, annual 1965-73

Cause	1954-59	1960-64	1965	1966	1967	1969	1970	1971	1973
					Percent				
Machinery 1/	35.3	38.6	40.6	41.9	41.8	41.0	42.0	42.8	43.0
Drowning	15.3	15.8	16.3	14.9	16.0	16.1	15.7	15.6	14.8
Firearms	12.2	10.5	9.7	9.7	10.1	9.2	8.6	8.6	8.2
Falls	5.5	6.5	6.6	6.6	7.0	6.2	7.0	6.5	6.7
Blows	8.7	6.8	6.4	6.4	6.0	6.8	6.4	6.0	6.6
Burns	5.0	5.3	4.6	4.6	4.4	3.7	3.2	3.4	3.8
Electricity	3.4	3.3	3.6	3.6	3.3	3.6	4.6	3.4	4.1
Poisoning	1.6	1.8	2.0	2.0	1.9	1.6	2.1	1.8	2.0
Other	13.0	11.4	10.3	10.3	9.5	11.8	10.4	11.8	10.8

1/ Includes categories "struck by falling object," "struck against object," and "caught between objects."

Source: U.S. Dept. of Health, Education, and Welfare, National Center for Health Statistics.

objects." Deaths resulting from overturning tractors are also included. Such accidents account for many work-related deaths, but probably result in fewer than 25 percent of all farm fatalities. Some State safety studies indicate that tractor fatalities have declined sharply from the high rates of the early sixties. 3/ The increased use of rollover protection equipment undoubtedly has contributed to this favorable trend.

Both drowning and firearm-related fatalities were somewhat lower in 1973 than the peaks registered in the sixties, but deaths resulting from falls appear to be maintaining the fairly uniform distributions of the earlier periods. Deaths due to burns appear to be easing downward, but deaths from electrical causes have been somewhat higher in recent years. Poisonings were responsible for only 2 percent of total 1973 farm fatalities. Gases and vapors were the major cause of poisonings, with motor vehicle exhaust gases responsible for almost half of the total deaths by poisoning. Two deaths were attributed to pesticides, fertilizers, and plant nutrients.

Regional Comparisons

Farm fatalities were not evenly distributed by State during 1969-71. Over 40 percent of all fatalities on farms occurred in the 12 States included in the Corn Belt, Northern Plains, and Lake States regions (table 3). An additional 38 percent occurred in the 12 Appalachian, Southeast, and Delta States.

Table 3--Accidental farm fatalities by region, average 1969-71

Region	Number	Region	Number
Northeast	179	Delta States	108
Lake States	200	Southern Plains	138
Corn Belt	389	Mountain	106
Northern Plains	156	Pacific	104
Appalachian	273		
		U.S. total 1/	1,820
Southeast	167		

1/ Excludes Alaska and Hawaii.

In 1974, family workers accounted for about 80 percent of the average annual employment on farms in these States. Florida is the major exception to heavy dependence on family workers in these regions, with hired employees accounting for about two-thirds of 1974 average annual farm employment. In only three other States do hired farmworkers account for at least half of the average annual employment: Arizona, California, and New Jersey, with 81, 77, and 50 percent, respectively. Hired farm employees account for about 48 percent of average annual employment on farms in Connecticut and Nevada. 4/

3/ The Kansas State Department of Health and Environment has maintained farmwork accident fatality data since 1939. During 1960-65, tractor-related fatalities accounted for 59 percent of all farm fatalities, peaking at 62 percent in 1960. By 1971, tractor-related fatalities had dropped to a low of 32 percent.

4/ Farm Labor. U.S. Dept. of Agr., Stat. Rptg. Serv., Jan. 1975.

Comparison of farm fatalities occurring between 1963-64 and 1969-71 show declines in the importance of firearms, blows from falling objects, and burns as causal agents (fig. 1). Slight increases were recorded for machinery and related causes and for deaths due to electrical short circuits. These changes at the national level were quite small, however, and provide no real indication of underlying trends.

More specific conclusions can be reached by resorting to regional comparisons. The importance of machinery and machinery-related fatalities increased over the period in all regions, except the Pacific and the Lake States. The largest increases occurred in the Appalachian, Delta, and Mountain regions, with the machinery-intensive Lake States, the Corn Belt, and the Northern Plains showing no change or only slight increases. The hilly terrain of the Mountain and Appalachian regions creates an additional hazard associated with machinery use that is not present in the Midwestern or Far Western States. Reasons for the increased importance of machinery-related deaths in the Delta States are more difficult to ascertain. The increase in machinery-related fatalities may reflect an actual increase in machinery-related hazards, relative shifts in causal relationships due to a reduction in drowning and firearm deaths, or both. Shifting of causal relationships by category may be responsible for the increase noted in the Mountain States, where a sharp decline in firearm-related deaths was recorded. Additional data concerning actual hazard exposure conditions in these regions are required to reach more definitive conclusions.

Drowning deaths showed no change or slight declines in the Applachian, Southeast, and Delta regions. Almost half of all drownings occurred in these three regions, which, because of a longer summer season, provide an extended exposure period to water hazards.

Firearm deaths declined in relative importance in all regions except the Corn Belt and Northern Plains. Hunting accidents in the Corn Belt claimed 111 lives in 1969-71, or almost a quarter of all hunting deaths in the United States during that period. Although the relative importance of hunting-related deaths declined in the Southern Plains States, this cause of accidental farm deaths accounted for over 15 percent of all fatalities in the region (table 4). The extent to which hunting fatalities are suffered by nonfarm residents not employed in agriculture is not known, but the data strongly suggest that additional educational emphasis on reduction of hunting deaths is required, especially in these two regions of high fatality occurrences.

Deaths related to falls, blows, and burns show inconsistent patterns within regions and show relatively little change at the national level. These deaths show strong correlations with certain age groups, however, and will be discussed further in that context.

During 1969-71, electrical causes of deaths showed increases over the 1963-64 period in the Northeast, Southeast, Delta, and Southern Plains regions, but accounted for no significant change in the Corn Belt, Mountain, and Pacific States regions. Over half of all electrical deaths on farms in 1969-71 occurred in the Southern Plains, Corn Belt, Mountain, and Pacific States regions. Poisoning as a cause of death declined or remained about constant in all regions except the Pacific, Northern Plains, and Corn Belt.

Significant regional differences exist among causes of farm fatalities (table 4). During 1969-71, machinery-related farm deaths were predominant in all regions but were relatively more important in the Northern Plains, Lake States, Northeast, and Corn Belt regions. Drowning accounted for 7 percent of the farm fatalities in the Lake States, in contrast to 28 percent in the Southeast region. Firearms accounted for over 15 percent of farm deaths in the Southern Plains region; falls were relatively significant causes of death in the Northeast and Pacific regions; and electrical deaths were strikingly higher in the Southern Plains, Mountain, and Pacific States than in other regions.

Table 4--Accidental farm fatalities by region and cause, average 1969-71

Cause	Northeast	Lake States	Corn Belt	Northern Plains	Applachian	Southeast	Delta	Southern Plains	Mountain	Pacific	U.S. total
					Percent						
Machinery 1/...	47.4*	48.1*	45.2	48.5*	41.6	32.9	38.4	29.3	37.7	37.8	41.9
Drowning.....	13.0	7.0	12.5	10.0	22.2*	28.1*	22.5*	19.6	14.8	11.3	15.8
Firearms.....	7.3	7.1	9.5	7.9	8.1	10.6	9.2	15.2*	6.6	6.4	8.8
Falls.....	8.7*	7.8	7.0	6.4	7.1	3.0	2.2	6.3	6.0	8.7*	6.5
Blows.....	6.9	7.2*	7.2*	7.5*	5.5	5.6	7.1	5.6	4.4	5.8	6.4
Burns.....	3.4	5.0*	3.4	1.9	2.4	5.0*	3.7	2.9	3.4	3.9	3.5
Electricity.....	2.0	2.5	3.1	3.4	2.3	3.6	5.5	7.8*	6.3*	8.9*	3.9
Poisoning.....	.9	2.3	1.6	1.9	2.1	2.2	1.2	1.9	1.3	2.6*	1.9
Other.....	10.4	13.0	10.5	12.4	8.7	9.0	10.2	11.4	19.5*	14.1	11.3

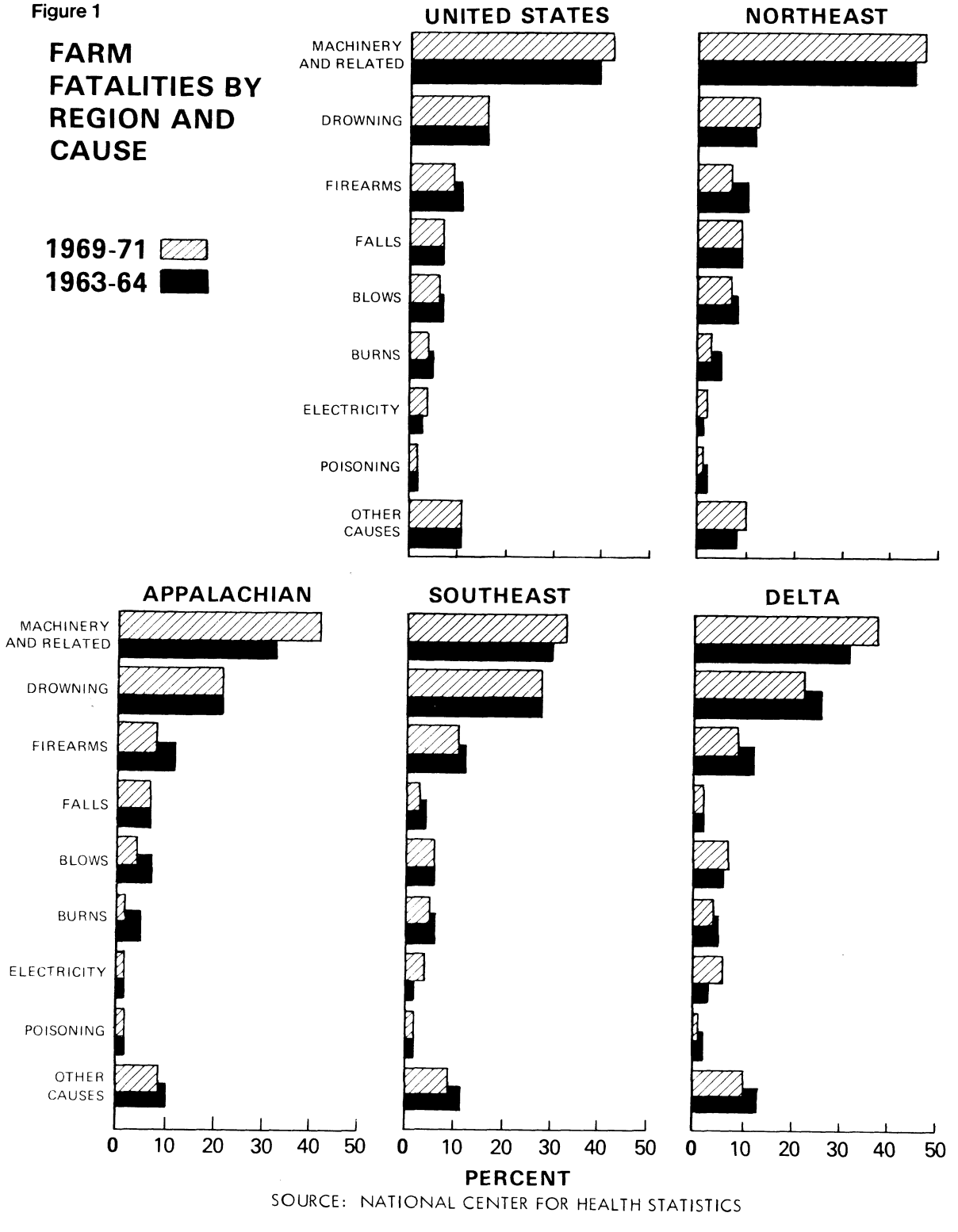
*Identifies a critical causal value. Critical values are defined as observations falling beyond the limit in which two-thirds of the values above the national average would be expected to lie.

1/ Includes categories "struck by falling object," "struck against object," and "caught between objects."

Source: U.S. Dept. of Health, Education, and Welfare, National Center for Health Statistics.

Figure 1

FARM FATALITIES BY REGION AND CAUSE



SOURCE: NATIONAL CENTER FOR HEALTH STATISTICS

USDA

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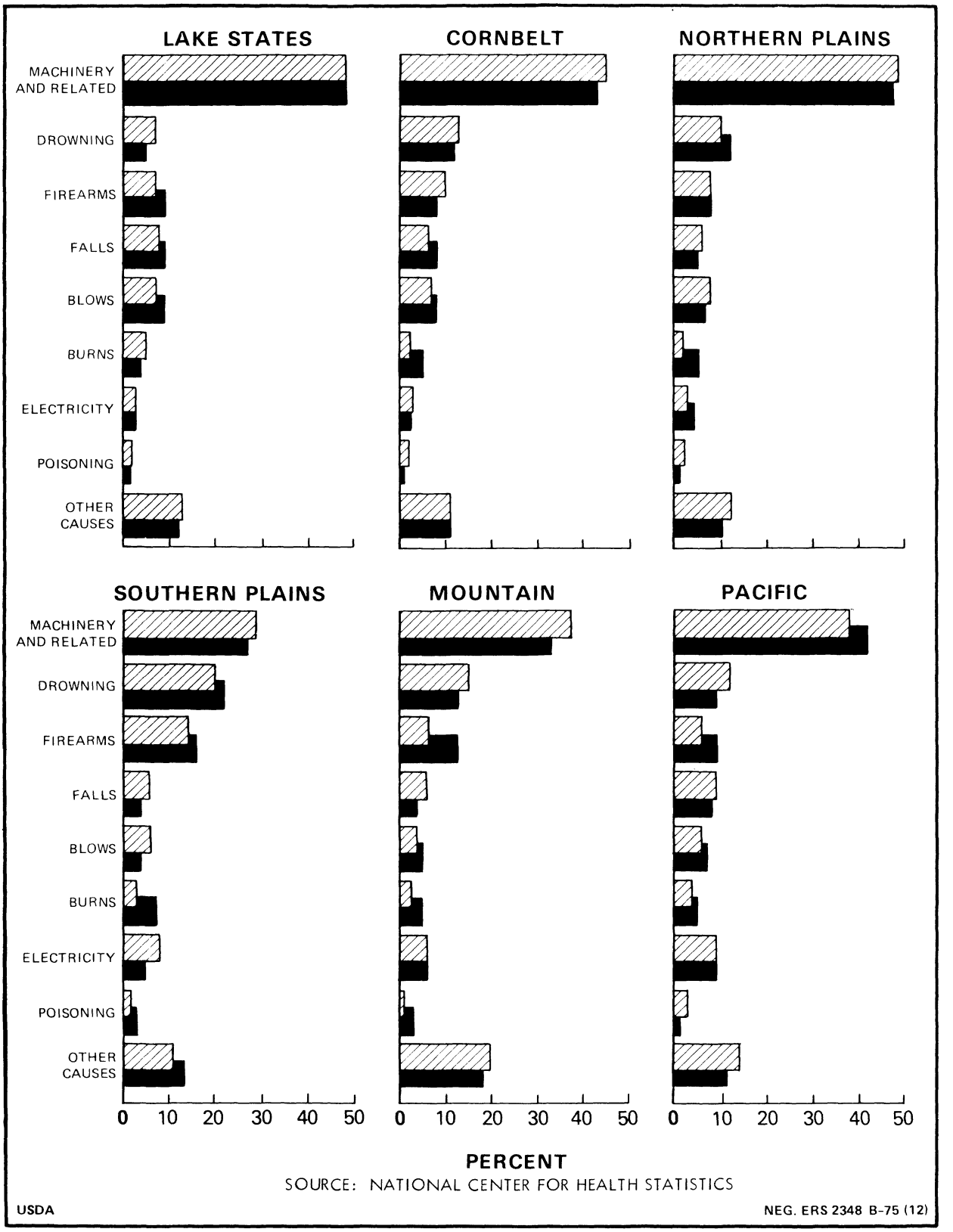
LAKE STATES
CORNBELT
NORTHERN PLAINS
SOUTHERN PLAINS
MOUNTAIN
PACIFIC
MACHINERY AND RELATED
DROWNING
FIREARMS
FALLS
BLOWS
BURNS
ELECTRICITY
POISONING
OTHER CAUSES
0 10 20 30 40 50
PERCENT
SOURCE: NATIONAL CENTER FOR HEALTH STATISTICS
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NEG. ERS 2348 B-75 (12)

National Age Distributions

The age distribution of the farm population shifted toward older persons between 1963-64 and 1969-71 (table 5). The percentage of persons 55 years old and older increased about 3 points, while the percentage of persons under 14 years old declined about 4 points. The percentage of persons between the ages of 14 and 24 rose about 1.5 points, reflecting an increase in the number of youths in the nonresident farm labor force. The percentage of persons in the prime labor force age--25 to 54 years old--declined only slightly.

Table 5--Farm people and accidental farm fatalities by age group, averages 1963-64 and 1969-71 1/

Age group (years)	1963-64		1969-71	
	Persons	Fatalities	Persons	Fatalities
	Percent			
Under 14	26.8	19.5	22.6	17.9
14-24	18.4	18.3	20.0	19.1
25-54	34.1	29.9	33.5	29.5
55-64	10.9	14.0	12.6	14.5
65 and older	9.8	18.3	11.3	19.0

1/ Farm people include both the farm population and the nonresident farm labor force.

In both 1963-64 and 1969-71, the share of farm fatalities occurring to persons 65 years old and older was almost twice their share of the total population and nonresident labor force. The percentage of fatalities occurring to persons in the prime labor force age was less than their population respresentation, and the frequency of fatalities involving 14- to 24-year-olds was approximately the same as their population representation.

Data in table 6 further emphasize the importance of age-correlated fatality occurrences. Total farm fatalities per 100,000 persons changed little between 1963-64 and 1969-71, increasing from 15.5 to 16.3. Improvements were recorded among persons 55 years old and older, but slight rate increases occurred among younger persons. However, the rate differentials between persons under 55 and those over 55 remained large, which indicates that special attention should be given to reducing accidental farm fatalities occurring to older persons. Approximately 2.3 million farm residents and an additional 360,000 hired employees were 55 years of age or older in 1974. 5/

5/ U.S. Dept. of Labor, Bureau of Labor Statistics, Employment and Earnings, Vol. 21, No. 7, Jan. 1975, and U.S. Dept. of Agr., Econ. Res. Serv., Hired Farm Working Force of 1974, Agr. Econ. Rpt. No. 297, July 1975.

Table 6--Farm fatality rates by age groups, averages 1963-64 and 1969-71

Age group (years)	Fatality rate per 100,000 persons	
	1963-64	1969-71
	Number	
Under 14	11.3	12.9
14-24	15.5	15.6
25-54	13.6	14.3
55-64	19.9	18.7
65 and over	28.9	27.4
Average	15.5	16.3

During 1969-71, machinery-related accidents accounted for over half of all fatalities sustained by persons over age 45 (table 7). Falls and blows from falling objects were also significant causes of accidental deaths to persons in these age groupings. Burns were relatively more important causes of fatalities to the very young and the very old, while drowning and firearm fatalities were significant among persons under 25. Although machinery-related causes accounted for the largest proportion of accidental deaths of persons in prime labor force age groups, fatalities due to electrical shocks occurred more frequently to persons 20 to 44 than to other age groups. Electricity-related death rates were also high in regions dependent on agricultural irrigation systems. This suggests that unsafe installation and handling of irrigation equipment may have been responsible for many of these fatalities.

Poison-related deaths accounted for fewer than 4 percent of all deaths by age group, but occurred more frequently among persons 15 to 44 years of age than to younger or older individuals. Most accidental poisonings (three-fourths in 1970 and two-thirds in 1973) were caused by gases or other poisonous vapors. Four deaths in 1970 and two in 1973 were attributable to pesticides, fertilizers, and plant nutrients. 6/

National Seasonal Occurrences

Fatal accidents on farms vary seasonally by causal factor (table 8). Machinery fatalities occur with greater frequency from May through October, when most land cultivating and harvesting activities occur. Simmilarly, three-fourths of all drownings occur during the spring and summer months, May through August. Firearm deaths peak in November, with almost half occurring during the October-December hunting season. Critical months for deaths due to falls coincide with summer and fall harvest activities, as well as with the onset of colder weather in late fall.

6/ U.S. Dept. of Health, Education, and Welfare, National Center for Health Statistics.

Table 7--Accidental farm fatalities by age group and cause, average 1969-71

Cause	Under 10	10-14	15-19	20-24	25-44	45-49	50-59	60-64	65 and over	All ages
					Percent					
Machinery 1/	34.2	29.3	27.2	30.2	40.2	51.2	52.6*	54.6*	50.8	41.9
Drowning	38.3*	34.1*	30.2*	16.3	10.0	7.1	5.3	4.3	5.9	15.8
Firearms	1.8	14.5*	18.2*	13.5*	9.9	8.8	7.8	6.1	3.5	8.8
Falls	4.6	2.4	1.6	5.7	5.4	3.7	6.5	9.7*	13.7	6.5
Blows	2.2	2.2	4.2	5.7	8.4	10.9*	10.4*	8.7	5.4	6.4
Burns	5.5	.9	.8	.6	2.3	4.7	2.5	3.1	7.7*	3.5
Electricity	.2	1.9	5.4	12.3*	8.6*	4.1	2.5	1.5	1.1	3.9
Poisoning	.7	.2	3.9*	3.8*	3.8*	1.7	1.3	.8	.4	1.9
Other	12.5	14.5*	8.5	11.9	11.4	7.8	11.1	11.2	11.5	11.3

*Identifies a critical causal value. Critical values are defined as observations falling beyond the limit in which two-thirds of the values above the national average would be expected to lie.

1/ Includes categories "struck by falling object," "struck against object," and "caught between objects."

Source: U.S. Dept. of Health, Education, and Welfare, National Center for Health Statistics.

Table 8--Accidental farm fatalities by cause and month, average 1969-71

Month	Machinery	Drowning	Firearms	Falls	Blows	Burns
			Percent			
January	3.4	3.2	8.7	5.9	7.2	8.5
February	3.4	2.4	4.2	4.7	6.0	7.4
March	5.7	3.6	5.4	6.4	8.6	14.8*
April	9.9	6.6	3.7	6.7	7.4	15.3*
May	11.6*	15.7	7.0	5.6	7.4	7.4
June	10.7	25.5*	5.6	9.8	9.7	9.0
July	11.1*	18.3*	4.6	12.3*	8.6	7.4
August	11.8*	13.3	5.6	8.6	8.0	3.2
September	10.0	5.3	8.9	11.2*	9.7	7.4
October	10.4	2.1	12.8	11.2*	12.9*	11.1
November	7.3	2.0	21.7*	10.6*	7.4	5.3
December	4.7	2.0	11.8	7.0	7.1	3.2

*Identifies a critical causal value. Critical values are defined as observations falling beyond the limit in which two-thirds of the values above the national average would be expected to lie.

Source: U.S. Dept. of Health, Education, and Welfare, National Center for Health Statistics.

OCCUPATIONAL FATALITIES

Not all farm residents are in the farm labor force. Of the 9.3 million persons living on farms in 1974, only 4.4 million were in the labor force, with about half of these persons in the farm labor force (table 9). By comparison, about two-thirds of the 1960 farm resident population in the labor force were in the farm labor force.

Concurrent with the declining proportion of farm residents with primary labor force attachment to farming is the increasing importance of nonfarm residents in the farm labor force. Only one-fourth of the persons in the 1960 farm labor force were nonfarm residents. By 1974, nonfarmworkers accounted for 41 percent of the total farm labor force (table 9).

Projection of these data suggests that the recent divergent growth trends between nonresidents in the farm labor force and persons in the farm population will continue into the future. The need to obtain additional insight into occupational hazards associated with the business of agriculture will also gain in importance.

Fatality data from coroners' reports do not provide direct counts of work- and nonwork-related fatalities. Estimates on nonoccupational fatalities can be obtained, however, by adopting the following assumptions:

(1) All deaths to persons under age 10 are nonwork related;

(2) all deaths to persons 10 years and over due to drowning and firearms are nonwork related; and

(3) the remaining fatalities to persons age 10 and over are work-related

Table 9--Farm labor force, 1960-74 1/

Year	Nonfarm resident farm labor force	Farm resident farm labor force	Total farm labor force
		Thousands	
1960	1,370	4,025	5,395
1961	1,529	4,025	5,554
1962	1,529	4,018	5,547
1963	1,609	3,762	5,371
1964	1,609	3,456	5,065
1965	1,564	3,261	4,825
1966	1,461	2,894	4,355
1967	1,466	2,678	4,144
1968	1,522	2,610	4,132
1969	1,378	2,485	3,863
1970	1,363	2,333	3,696
1971	1,377	2,291	3,668
1972	1,370	2,308	3,678
1973	1,480	2,249	3,729
1974	1,531	2,242	3,773

1/ This data series is based on five-quarter averages centered on April. Because these are annual averages of worker responses, they represent only persons whose major source of employment is farmwork. Adjustments for dual job holding are not made. Hence, the data somewhat undercount the total persons doing farmwork during the year.

Source: U.S. Dept. of Commerce, Farm Population Series P-27, various issues.

Fatalities on farmland due to drownings and firearms are generally nonoccupational in nature. With few exceptions, drownings occur as a result of rural recreational pursuits. It further appears reasonable that most accidental fatalities to children under age 10 are nonwork related. Although machinery is involved in about one-third of all fatalities to children in this age category, few of these deaths can be clearly related to strictly occupational endeavors. Children may be around machinery or riding on tractors or wagons and as a result become involved in a fatal accident. It appears more nearly correct to allocate such fatalities to a category separate from accidents occurring to persons actually in the agricultural work force. Attributing all fatalities to children between the ages of 10 and 14 to occupational causes, as is done under the third assumption, will, no doubt, largely compensate for any understatement introduced by the first assumption.

Nonwork-related accidental fatalities decreased nationally as a proportion of all accidental fatalities over the period studied (table 10). This was due to a decline in deaths to children under 10 as a proportion of all deaths, and a reduction in the proportion of firearm-related fatalities. The proportion of drowning deaths to persons 10 and over increased, however.

Table 10--Accidental nonoccupational farm fatalities

Category	Share of all farm fatalities	
	1963-64	1969-71
	Percent	
Under age 10	12.1	10.0
Drownings 1/	11.2	12.0
Firearms 1/	10.0	8.7
Total	33.3	30.7

1/ Excludes fatalities due to firearms and drowning previously included in the under 10 age group.

The reduction of deaths of young children is probably because a smaller number of children live on farms--a result of the aging of the farm resident population. The reduction in firearm-related deaths can be attributed to either an actual improvement in safety habits of hunters, or it may be the result of a decline in the proportion of the farm population and labor force participating in this sport. (It is not possible to determine from these data the number of hunting fatalities suffered by visitors.)

Under the basic assumption, about 70 percent of the recorded farm fatalities during the 1969-71 period were work related. However, associating all accidental farm fatalities of persons 65 and over with work-related accidents, as is done under the first set of assumptions, probably overstates the actual count. Since only 43 percent of the farm resident males in this age category were still in the labor force during the 1969-71 period, 7/ it is reasonable to assume that many fatalities to persons in this age group were nonwork related. Although some may still be engaged in part-time farming, it appears more nearly correct from an occupational perspective to consider these efforts as avocational rather than strictly vocational pursuits. Allocating half of all fatalities of this group to nonoccupational causes does not appear unwarranted.

A further complicating factor is the allocation of fatalities due to natural causes. The natural farm environment poses many hazards which can result in the deaths of farmworkers, residents, or visitors regardless of the specific activity the person is engaged in at the time of the fatality. Such deaths result from snake bites, lightning strikes, and other natural causes, and the incidence cannot be *a priori* determined as work or nonwork related. Hence it also appears reasonable to allocate only half of these deaths to occupational causes. A summary of these adjustments appears in table 11. Addition of these potentially nonwork-related fatalities to the previous estimates increases the nonoccupational fatality occurrences to 43.9 percent of the 1963-64 total and 41.5 percent of the 1969-71 total.

Taking the remaining fatalities under each set of assumptions as occupationally related and dividing by the average annual farm employment for each of the two periods under discussion yields estimates of the incidence rates for occupational fatalities occurring on farms. These figures are summarized in table 12.

7/ Bureau of the Census, U.S. Census of Population, 1970 General Social and Economic Characteristics, U.S. Summary, PC(1)-C1.

Table 11--Possible nonoccupational farm fatalities

Category	Share of all farm fatalities	
	1963-64	1969-71
	Percent	
Half of fatalities due to natural causes 1/	3.4	3.3
Half of fatalities occurring to persond 65 and over 1/	7.2	7.5
Total	10.6	10.8

1/ Excludes fatalities included under previous nonoccupational categories.

Table 12--Occupationally related farm fatalities and fatality rates

Category	Farm fatalities		Fatalities per 100,000 workers 1/	
	1963-64	1969-71	1963-64	1969-71
	Avg. per year		Number	
All farm fatalities	2,294	1,821	---	---
Minimum occupationally related	1,285	1,065	20.4	23.5
Possible occupationally related	243	197	3.8	4.4
Maximum occupationally related	1,528	1,262	24.2	27.9

1/ Rates are based on annual average family and hired agricultural employment data published by USDA, Statistical Reporting Service, Farm Labor. This data source provides employment estimates on an industry basis comparable to employment estimates published by the Bureau of Labor Statistics for nonagricultural industries.

Occupational fatality rates increased somewhat over the period. A minimum incidence rate of 23.5 fatalities per 100,000 workers was estimated for 1969-71, compared with 20.4 in the earlier period. Upper estimates were 24.2 and 27.9 for 1969-71 and 1963-64, respectively. 8/

8/ These rates compare favorably with nonhighway occupational fatality rates of 24.7 and 31.5 recorded for California and Kansas, respectively, in 1970. The California rate represents hired workers while the Kansas rate measures fatalities sustained by self-employed and hired workers. Including highway deaths increases the California rate per 100,000 workers to 39. Highway work related fatalities are of greater significance in this State than in most other States because employees are regularly transported to jobs by employers or labor contractors.

It is not possible to further disaggregate these data and calculate separate occupational rates for the hired and self-employed farm work force. Assuming that fatality rates by age group are similar for both self-employed and hired workers leads to the conclusion that occupational fatality rates for the hired work force are somewhat lower than for the self-employed work force since there are proportionately fewer employees in the high risk age categories over 54 years of age. About 45 percent of the self-employed farm work force was 55 years of age and over during 1969-71, compared with less than 20 percent of the hired farm working force. 9/

CONCLUSIONS

Occupationally related fatalities result in up to 2.5 million person hours of work lost annually in the agricultural industry. In addition, thousands of farm children, youth, and adults die or are needlessly injured each year because of nonoccupational accidents. Contributing factors associated with both occupational and nonoccupational fatalities vary greatly by region and age classification.

Machinery and related factors are involved in about 40 percent of all farm fatalities nationally and in almost half of the fatalities sustained in the Midwest and Northeastern parts of the country.

Comparisons between two time periods, 1963-64 and 1969-71, indicate that machinery and related factors were involved in a greater proportion of the fatalities in the later period. But changes in the machinery-intensive agricultural regions such as the Lake States, the Corn Belt, and the Northern Plains were minimal. The Pacific region, dominated by California, which has a highly mechanized agriculture and uses a predominately hired farm work force, recorded a decline in the proportion of fatalities involving machinery. Recent State studies suggest that tractors are declining in importance as a causal factor of farm fatalities in the Midwest. Tractors were involved in 62 percent of the 1960 Kansas farm fatalities, while a low of 32 percent was recorded in 1971.

It is important to note, however, that in all regions machinery and related factors account for a higher proportion of fatalities to persons 45 years old and older than to younger persons. Over half of all accidental farm fatalities occurring to persons 45 and over result from machinery or related causes, compared with 30 percent or less among persons 14-24 and 40 percent for persons 25-44. Adherence to machinery safety standards, codes, and operating procedures must be stressed for all age groups, but safety educators should direct specific emphasis toward the more mature and older operators of farm equipment. Without such constant emphasis, the familiarity associated with experience can result in unnecessary loss of life due to overconficence and lack of mental alertness to machinery operating hazards.

Drowning accidents, the second leading cause of farm fatalities, are generally greatest in regions where climatic conditions permit a longer period of water recreational activity. The high incidence of drowning fatalities to persons under age 25 indicates that special educational programs should be directed toward these persons.

Firearm-related deaths were the third most important cause of farm fatalities in 1969-71, but declined or remained constant in relative terms from the 1963-64 period

9/ U.S. Dept. of Labor, Bureau of Labor Statistics, Employment and Earnings, various issues.

in all regions except the Corn Belt. This indicates that either improved safety practices are being followed or less hunting is occurring on farmland. Additional information is required to produce a more substantive evaluation.

The upward trend in fatalities related to electricity in regions where irrigated agriculture dominates points to yet an additional need for greater electrical safety efforts. The Southern Plains, Mountain, and Pacific States all have significantly higher fatality rates in this category than do the other regions. The age group 20-44 sustains the greatest proportion of the electrically induced fatalities. Yet, specific year-to-year trends are difficult to discern in these higher risk regions. Contributing local factors, such as adherence to safety codes and safe working practices when installing or operating electrical equipment, require improved understanding.

There has been a downward trend in fatalities caused by burns. But since the data cover only fatalities, this reduction should not be interpreted as an overall decline in burns sustained by the farm population and farm labor force. Instead, it partly reflects improved medical practices in the treatment of burn victims. More precise information is needed in this area.

The percentage of fatalities caused by falls and blows has not changed significantly over the years, and there is no apparent rationale for the quite insignificant proportional differences between regions. The data indicate that fatalities related to falls and blows increase with age, reflecting perhaps less agility, physical limitations such as losses in hearing and sight, and less ability to recover from the injuries. It is of interest that persons in the still-active work age range of 45-59 experienced more fatalities related to blows, while falls accounted for a larger proportion of casualties to those 60 and over.

The percentage of fatalities attributed to poisons and other causes are fairly stabilized over time and there are no significant regional differences. Poisoning fatalities by age groupings point out the need for keeping agricultural poisons out of reach of small children and greater concentration of educational efforts on the safe use of agricultural poisons toward teenagers and young farmers as they become involved in the application of poisons in farming operations.

Over the period studied, important shifts occurred in the farm population and in the farm resident and nonfarm resident agricultural labor force. The farm population declined from 15.6 million in 1960 to 9.3 million in 1974, and the farm resident labor force declined from about 4 million to 2.2 million. Nonfarm resident workers, most of whom are hired workers, made up about 25 percent of the 1960 agricultural labor force, but increased to over 40 percent in 1974.

These population and labor force changes shifted a greater proportion of the farm population and the resident farm labor force into the age classes 55 years and over. However, persons 55 and over made up a smaller proportion of the nonfarm resident agricultural labor force in the later years of the study period.

The shift over time toward (1) an older farm population, (2) an older farm resident farm labor force, but (3) a younger nonfarm resident farm labor force has important implications for interpreting accident rates and developing approaches to safety education. Persons 55 and older made up less than one-fourth of the 1969-71 farm population and nonresident farm labor force but accounted for over a third of the total fatalities. However, persons between the ages of 25 and 54 made up about a third of the population but less than 30 percent were fatality victims.

Occupational fatality rates developed for 1963-64 and 1969-71 indicated that for every 100,000 agricultural workers, between 20 and 24 workers suffered fatal accidents in the earlier period compared with 24 and 28 in the later period. It is very likely

that the increase in fatality rates is more closely related to the aging of the farm population and the resident farm labor force than to a significant increase in occupational hazards associated with farming. If this reasoning is correct, it further implies that fatality rates for the hired farm labor force are lower than for the self-employed labor force, assuming fatality rates by age classes are similar for both groups.